REMARKS

The Office Action of April 8, 2004 has been carefully reviewed. Claims 1-14 and 16-24 are pending in the application. Claim 1 has been amended herein to delete formula XV and formula XXXIX. Applicants respectfully acknowledge that claim 14 has been allowed. Claim 1-6, 10-13, 16-20 and 24 are rejected and claims 7-9 and 21-33 have been objected to in the Office Action.

More specifically, claims 1-6, 10-13, 16-20, and 24 are rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1-5, 15, 16, 19, 20, 22, and 23 of U.S. Patent No. 6,297,329. The conflicting patent is commonly owned and a terminal disclaimer is submitted herein to overcome this rejection.

Claims 10, 11, and 16-19 stand rejected under 35 U.S.C. 102(b) as being anticipated by Hall et al. (U.S. Patent No. 4,405,798). This rejection is respectfully traversed.

Hall describes the preparation of (meth)acryloyl-functional bicyclic orthoester monomers. These monomers may be hydrolyzed and homopolymerized or copolymerized to provide resins. If the resins are of low molecular weight, these resins can impart advantageous properties to coating compositions. Polymerization is carried out under the influence of azobisisobutyronitrile (AIBN) initiator. AIBN is a well known radical generating initiator. During radical polymerization the (meth)acrylic double bonds are depleted to form the polymer chain. This is general knowledge and can be inferred from the textbook "*Introduction to Paint Chemistry*" by J. Bentley and G.P.A. Turner at pages 64-65, a copy of which is attached hereto.

Therefore, one skilled in the art would recognize that the resins described by Hall for use in a coating composition are depleted of (meth)acrylic double bonds. Hall does

not teach, suggest, or disclose using the (meth)acryloyl-functional bicyclic orthoester as such in a coating composition as required by the present claim 10. Thus, claim 10, claims 11 and 16-19 depending thereon, and claim 24 directed toward a process of curing the composition according to claim 24 are novel over Hall.

Claims 10, 11, and 16-19 stand rejected under 35 U.S.C. 102(b) as being anticipated by WO 97/31073 and 35 U.S.C. 102(e) as being anticipated by van den Berg et al (U.S. Patent No. 6,297,329 or U.S. Patent No. 6,593,479). This rejection is respectfully traversed.

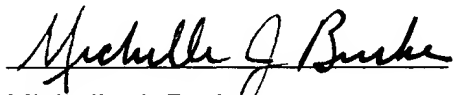
WO 97/31073 does not disclose a coating composition comprising a compound comprising a bicycle-orthoester group having any of the specific hydroxyl reactive functional groups C according to amended claim 1. Therefore, amended claim 1 and its dependent claims 2-6 are novel over WO 97/31073. Further, no where in the Office Action is it specifically pointed out where WO 97/31073 discloses a compound comprising a bicycle-orthoester group having any of the specific hydroxyl reactive functional groups C according to claim 10. Actually, WO 97/31073 does not disclose a coating composition comprising a compound comprising a bicycle-orthoester group having any of the specific functional groups C according to claim 10. Therefore, the present claim 10 and its dependent claims 11, and 16-19, and the process of curing the composition of claim 10 according to claim 24 are considered novel over WO/9731073. Neither van den Berg '329 nor van den Berg '479 overcomes the deficiencies in WO/931073.

It is noted that claims 7-9 and 21-23 are objected to as being dependent upon a rejected base claim, but would be considered allowable if rewritten in independent form. However, as claim 1, as amended herein, is believed to be allowable, claims 7-9 and 21-23, depending upon the amended claim 1, are also believed to be allowable.

Thus, the present invention is considered both novel and non-obvious over the prior art. Applicants respectfully request reconsideration of the rejected claims and a finding that the claims are in condition for immediate allowance.

If an extension of time is required, Applicant herein petitions for such extension of time such that this response is timely. Applicant herein authorizes that any and all charges due be charged to its Deposit Account No. 01-1350.

Respectfully submitted,
HOBEL et al.



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Introduction to
Paint Chemistry
and principles of paint technology

J. Bentley

and

G. P. A. Turner

Both formerly with ICI Paints
Slough, Berkshire, UK

Fourth edition

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Contents

the distinctive property of an amorphous solid is that, when a melt is poured into a tray, or when a solution of the solid is poured upon a surface and the solvent is allowed to evaporate, the resultant solid forms a *continuous* film. Because it has no natural shape of its own, it takes the shape into which it has been cast. A crystalline material would give a discontinuous film, consisting of many hundreds of tiny individual crystals. It is the amorphous continuity that makes the resin film extremely suitable for protecting surfaces.

Polymers

Natural resins are complex mixtures of different substances with fairly large molecules. Nowadays many synthetic resins are used in paints. Synthetic resins have many properties that their natural predecessors did not, but they also consist of mixtures of different molecules, all of which are large.

Synthetic resins are **polymers**. 'Poly-mer' means 'many parts'. A polymer molecule is composed of many smaller parts, contributed by similar or dissimilar molecules, which are joined together until there are hundreds or thousands of atoms in the polymer molecule.

Chain growth polymers

Ethylene (ethene), $CH_2=CH_2$, is an example of a simple molecule that can be reacted to form a polymer or become **polymerized**. If ethylene gas is highly compressed (1500 atm), heated to 200 °C and allowed to come into contact with a carefully controlled trace of oxygen, the following occurs:

- Oxygen attacks a double bond, opening it. Temporarily a free radical has been created:

$$O_2 + CH_2{=}CH_2 \longrightarrow CH_2{-}\dot{C}H_2 \quad \text{(or } R{-}CH_2\cdot\text{)}$$
$$\qquad\qquad\qquad\qquad\quad O$$
$$\qquad\qquad\qquad\qquad\quad O.$$

- The highly reactive free radical attacks another double bond:

$$CH_2{=}CH_2 + \dot{C}H_2{-}R \longrightarrow CH_2{-}\dot{C}H_2 \;|\; R \xrightarrow{+CH_2=CH_2} CH_2{-}\dot{C}H_2 \;|\; CH_2{-}CH_2 \;|\; R$$

and so on

A **chain reaction** has been set in motion and the $-CH_2-CH_2-$ unit will repeat itself a thousand times or more in forming a huge molecule of the polymer, polyethylene or polyethene ('polythene').

Polyethylene (polyethene) is not used in paints, because of its marked crystallinity (see below). However, many compounds containing the vinyl ($CH_2=CH-$) or vinylidene ($CH_2=C<$) group can be polymerized by a free radical route and many of the products are useful in paints, as we shall see, e.g.

$CH_2=CHCl$ — PVC (polyvinyl chloride)
vinyl chloride (chloroethene)

$CH_2=CH-O-CO\cdot CH_3$ — PVAc (polyvinyl acetate)
vinyl acetate (ethanoyloxy-ethene)

$CH_2=C(CH_3)-CO-O-CH_3$ — PMMA (polymethyl methacrylate, 'Perspex')
methyl methacrylate (methyl 2-methyl-propenoate)

$CH_2=CH-CO-O-(CH_2)_3-CH_3$ — PBA (polybutyl acrylate)
butyl acrylate (butyl propenoate)

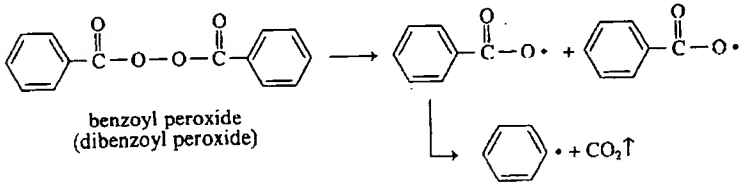
Usually the **monomer** (as the starting compound is called) is liquid and can be polymerized in bulk or in solution. The **initiator** of polymerization is not oxygen, but some compound which, on heating, decomposes into free radicals, e.g. an organic peroxide (Table 5.1). The first reaction of free radical with a monomer molecule is terms the **initiation step**.

The most frequently encountered peroxides are compounds which decompose at temperatures between 80 and 180 °C. They all possess the link $-O-O-$ found in the simple inorganic compound hydrogen peroxide, but with one or both hydrogen atoms substituted by other groups as shown on page 66. Those peroxides with only one hydrogen substituted are called **hydroperoxides**, and they are particular important in the oxidative drying of oils (Chapter 12).

Other compounds used are **azo compounds** with a $-N=N-$ bond; azo-diisobutyronitrile (ADIB) is a common example. These compounds decompose as follows:

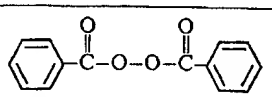
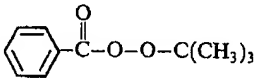
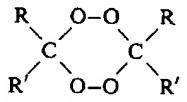
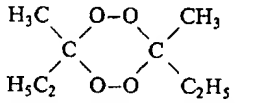
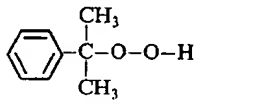
$$CH_3{-}C(CH_3)(CN){-}N{=}N{-}C(CH_3)(CN){-}CH_3 \longrightarrow 2\,CH_3{-}C(CH_3)(CN)\cdot + N_2\uparrow$$

ADIB



benzoyl peroxide
(dibenzoyl peroxide)

Table 5.1 Organic peroxides

Attached group(s)	Peroxide type	Comments	Example
1. $2R-\overset{O}{\overset{\|}{C}}-$ acyl groups	$R-\overset{O}{\overset{\|}{C}}-O-O-\overset{O}{\overset{\|}{C}}-R$ diacyl peroxide	R may be aliphatic or aromatic	 benzoyl peroxide (dibenzoyl peroxide)
2. $R-\overset{O}{\overset{\|}{C}}-$ and $-R'$ alkyl	$R-\overset{O}{\overset{\|}{C}}-O-O-R'$ peracid ester	ester of the peracid, $R-\overset{O}{\overset{\|}{C}}-O-O-H$	 *tert*-butyl perbenzoate
3. 	 ketone peroxide	or aldehyde peroxide if R′ is H	 methyl ethyl ketone peroxide
4. R– and –H	R–O–O–H hydroperoxide		 cumene hydroperoxide
5. 2R–	R–O–O–R dialkyl peroxide		$(CH_3)_3\cdot C-O-O-C\cdot(CH_3)_3$ di *tert*-butyl peroxide

The sequence of growth steps, normally termed **propagation**, of the polymer chain is terminated by one of the following occurrences:

- **Combination.** An encounter between two polymer free radicals which satisfy one another's free valencies:

$$R\cdot + \cdot R' \longrightarrow R-R'$$

- **Disproportionation.** A similar encounter, in which one free radical removes a hydrogen atom from the other to become a saturated compound. The double radical rearranges to an unsaturated compound; neither free radical survives:

$$\begin{array}{lcl} R'-\underset{\displaystyle H}{\underset{|}{CH}}-CH_2\cdot & R'-\dot{C}H-CH_2\cdot & R'-CH=CH_2 \\ +\ \dot{R} & \longrightarrow \quad + & + \\ RH & & RH \end{array}$$

- **Chain transfer.** The polymer free radical is satisfied by the removal of a monovalent atom (usually hydrogen) from another molecule:

$$R\cdot + R'H \longrightarrow RH + R'\cdot$$

One polymer chain is ended, but another begins, as a result of the creation of a new free radical. Hence the chain reaction is 'transferred' to another molecule. The hydrogen atom may be removed from:

- another monomer molecule;
- a solvent molecule;
- another polymer molecule, in which case further polymer will grow from the transfer site resulting in a branched rather than a linear structure;
- a compound called a **chain transfer agent**, specially included in the preparation for this purpose.

A reactive material which may also be present but which hinders or prevents polymerization taking place is known as an **inhibitor**. Hydroquinone (benzene-1,4-diol),

and other phenolic materials are effective in reacting with free radicals to destroy their free radical nature, e.g.

where X is an alkyl group and the inhibitor a trialkyl phenol.